Unraveling the mysteries of the tiniest living things

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There are trillions of them – millions fitting through the eye of a needle – and they are everywhere. They live and thrive in vast communities in the environment, such as soil, rivers and oceans, and atmosphere, and in the human body. But they also exist in the oddest of places, such as extreme environments like volcanic hot springs and long-frozen ice in the Arctic.

Invisible to the human eye, they are communities of microorganisms, archaea (Greek for “ancient things”), fungi and viruses. Each community, or microbiome, can be thought of as an individual metropolis, each as different as New York City is from Albuquerque.

What’s fascinating about microbiomes is how they contribute to the “big” world. For example, various types of microbiomes thrive in the human body. Those in the human stomach help the gut absorb nutrients and minerals, as well as synthesize vitamins, enzymes (to help with digestion, among other things) and amino acids (the building blocks of proteins). This microbiome also helps train the body’s immune system battle tiny invaders, such as bacteria and viruses.

The key to understanding microbiomes is to unravel the genetic makeup of each microbe in a microbiome and establish a common data “language” that researchers can use to compare and contrast these complex communities, regardless of scientific discipline. To do this, the Department of Energy’s Office of Biological and Environmental Research has provided $10 million to establish a National Microbiome Data Collaborative. Spearheaded by Lawrence Berkeley National Laboratory, this collaborative consists of Los Alamos, Oak Ridge and Pacific Northwest national laboratories. By bringing together various scientific disciplines, the collaborative expects to unlock new possibilities derived from a better understanding of why microbiomes reside in specific environments and exactly how they work within their microbial communities.

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